

WHAT IS CLAIMED IS:

1. An integrated fluid flow,
temperature and pressure sensor, said sensor
comprising:

5 a body including a path for the flow of
fluid:

temperature determining means located
within said body, and coupled to said path, for
making a determination of the upstream temperature
of a fluid flowing in said path:

10 heating means located within said body,
and coupled to said path, for transferring heat
from said heating means to said fluid;

control means located within said body,
and coupled to said heating means and to said
15 temperature determining means, for applying power
to said heating means in an amount required to
raise the temperature of said heating means above
said upstream temperature by a predetermined
amount, and for converting the value of said power
20 into a flow signal representing a corresponding
flow;

pressure sensing means located within
said body, for sensing fluid pressure in said path
at a location adjacent to one of said heating
25 means and said temperature determining means, for
generating an electrical signal representative of
the pressure of said fluid;

signal processing means located within
said body, and coupled to said control means, to
30 said temperature determining means, and to said

pressure sensing means, for processing said flow
signal, said temperature signal, and said pressure
signal, for generating digital signals
representing said flow, said temperature, and said
35 pressure, for transmission over a digital signal
transmission path; and

signal connection means mounted on said
body, and connected to at least said signal
processing means, for providing a standard
40 connection between said signal processing means
and said signal transmission path.

2. A sensor according to claim 1,
wherein said pressure sensing means located within
said body, generates an analog electrical signal
representative of the pressure of said fluid.

3. An integrated sensor according to
claim 1, wherein said control means comprises a
second temperature determining means coupled to
said heating means, for determining the
5 temperature of said heating means.

4. An integrated sensor according to
claim 3, wherein said second temperature
determining means is an electrical resistor, and
said second temperature determining means
5 comprises means coupled to said heating means for
measuring the electrical resistance of said
heating means, and said control means comprises
means for converting the value of said resistance

into a corresponding temperature.

5 5. An integrated sensor according to
claim 1, wherein said control means comprises a
memory preprogrammed with a value corresponding to
the cross-sectional area of said path, and said
flow determination is in the form of one of mass
quantity per unit time and volume per unit time.

5 6. An integrated sensor according to
claim 1, wherein said path is associated with a
peripheral wall, and wherein said heating means is
in the form of a peripheral structure surrounding
said peripheral wall, and in thermal contact
therewith.

5 7. An integrated sensor according to
claim 6, wherein said peripheral wall is made from
conventional materials having a thickness
commensurate with the pressure and temperature of
said fluid, except in a region near that in which
said heating means is thermally coupled, in which
region said peripheral wall is made from a
material having higher strength than said
conventional materials, of a thickness less than
10 said commensurate thickness.

8. An integrated sensor according to
claim 1, wherein said control means and said
signal processing means are integrated into a
single unit.

9. An integrated sensor according to claim 1, wherein said pressure sensing means is a ratiometric pressure sensor.

10. An integrated sensor according to claim 1, wherein said pressure sensor is a microelectromechanical system device.

11. An integrated sensor according to claim 1, further comprising

5 a controllable valve having a controllable flow channel connected by a further fluid path to said flow path of said integrated sensor, said controllable valve being within said body; and

10 a control processor at a location remote from said body of said integrated sensor, and coupled thereto by way of said transmission path, for correlating valve state with fluid flow for one of (a) verifying operation of an element of said integrated sensor and (b) verifying the integrity of fluid paths to which said integrated
15 sensor is connected.

12. An integrated fluid flow, temperature and pressure sensor, said sensor comprising:

a body including a path for the flow of fluid in a region:

a temperature sensor located within said

body, and coupled to said path, for making a
5 determination of the upstream temperature of a
fluid flowing in said path:

a heater located within said body, and
thermally coupled to said path, for transferring
heat from said heater to said fluid;

10 a controller located within said body,
and coupled to said heater and to said temperature
sensor, for applying power to said heater in an
amount required to raise the temperature of said
heater above said upstream temperature by a
15 predetermined amount, and for converting the value
of said power into a flow signal representing a
corresponding flow;

a pressure sensor located within said
body, for sensing fluid pressure in said path, for
20 generating an electrical signal representative of
the pressure of said fluid;

a signal processor located within said
body, and coupled to said controller, to said
temperature sensor, and to said pressure sensor,
25 for processing (a) said flow signal, (b) said
temperature signal, and (c) said signal
representative of the pressure, for generating
digital signals representing said flow, said
temperature, and said pressure, for transmission
30 over a digital signal transmission path; and

a signal connector mounted on said body,
and connected to at least said signal processor,
for providing a standard connection between said
signal processor and said signal transmission

35 path.

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